Stress/Strain properties of Cartilage

Jaws and their supporting structures have, according to the current paradigms, evolved various morphologies that correspond to ecological function. Chondrichthyans, or sharks, skates, and rays, possess an entirely cartilaginous skeleton. While bony skeletons have been well studied, cartilage as a skeletal material remains poorly understood. Chondrichthyans have a unique skeleton of uncalcified hyaline cartilage that is superficially reinforced by blocks of calcified cartilage called tesserae, interconnected by ligamentous joints, thereby providing strength while still permitting flexibility. Our current research attempts to assess morphological variation, quantify mechanical properties, and estimate mechanical performance (i.e., stress and strain) in the cartilaginous jaws and associated support structures. We aim to test explicit hypotheses about the relationship between shape and function to assess ecological and evolutionary patterns in jaws. We predict that function (i.e. feeding behaviors such as biting, ripping, tearing, grasping) will be ecologically and evolutionarily correlated with transformations in mechanical performance. However, more broadly, an increased understanding of cartilage performance and its ablilty to withstand stress and strain may provide insight into in vivo cartilage maintenance in non-chondricthyan models (i.e. humans), and into cartilage replacement therapies. Students will be expected to collect data from chondricthyan species, generate performance models, and conduct analyses of the data.

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